

# Can the Limits of Outsourcing be monitored and controlled?

## A Research on Risk Based Maintenance and the Potential Implementation of Resilience Engineering

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### 1. Introduction

*This research looks at the extent to which business processes can be outsourced without the organisation losing control over these processes. In this study the focus is on the programme of Risk Based Maintenance (RBM) in particular.*

*The reason for the focus on outsourcing of RBM comes from the cooperation with Rijkswaterstaat (RWS, the executive organisation of the Dutch Ministry of Infrastructure and the Environment) and the observed tension between the programmes of RBM and Lean Management within that organisation. The goal of RBM is to improve the safety and availability of objects based on the calculated risk of failure of performance. This is a concrete but not a direct contribution to the primary tasks and responsibilities of RWS. Lean Management however tries to reduce costs by outsourcing all activities that do not contribute directly to the primary tasks and responsibilities of the organisation. Where RBM focuses on the effectiveness of the business processes of Risk Based Maintenance, Lean Management aims to make those business processes as efficient as possible. Where lies the balance between effectiveness and efficiency? Put in other words: 'How Mean can Lean be?'*

*The central research question is: What are the criteria for a tolerable degree of outsourcing of RBM activities to external parties, without losing control of RBM targets and the functioning of the organisation as a whole?*

*The goal of this research is to make recommendations on the implementation of programmes with regard to the efficiency and effectiveness of the organisation by providing insight into the criteria of the tolerable degree of outsourcing, in particular for RBM activities. By request of RWS this research will look at Resilience Engineering as a possible tool for determining whether or not activities should be outsourced.*

### 2. Theory

This study supposes a relation between the degree of outsourcing and the functioning of RBM activities. It analyses what the criteria are for the tolerable degree of outsourcing and for the functioning of RBM activities. How these criteria influence each other will give an indication of the criteria for the tolerable degree of outsourcing of RBM activities.

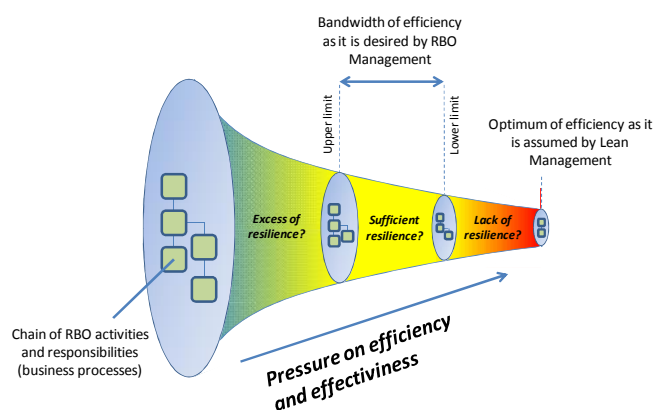


Figure 1: The Balance between RBM and Lean Management

*Outsourcing*

The definition of outsourcing is to obtain (goods or a service) by contract from an outside supplier (<http://www.oxforddictionaries.com/definition/english/outsource>). The process of outsourcing consists of different phases of which the first two must be seen as a project; once-only, temporary and with a clearly defined goal. Outsourcing is different from contracting because of the collaboration between the commissioning party and contracted party. These results in a long-term, open relation with the supplier so there will be more control over the quality of the goods or service delivered.

This research supposes that outsourcing involves activities that are critical to the main business process of the commissioning party, which are transferred to the contracted party in the form of a delivery of goods, services or a whole business process. An essential part of the responsibility for

these critical activities remains with the commissioning party. Often cost reduction is seen as the main goal for outsourcing. While the main reasons all have a financial foundation, outsourcing is also supposed to improve the competitive position and increase quality by focusing on primary tasks of the organisation.

To understand the term ‘degree of outsourcing’ an explanation of the phases of outsourcing is useful. The Qualification phase is about determining which activities qualify for outsourcing, the Selection phase is an a priori check and feedback on phase 1, the Tender phase involves the choice for a contracted party and the last phase; Evaluation checks whether the contract is observed. This is an a posteriori check and feedback. The research question is mainly concerned with the Selection phase and the a priori feedback before a tender is invited.

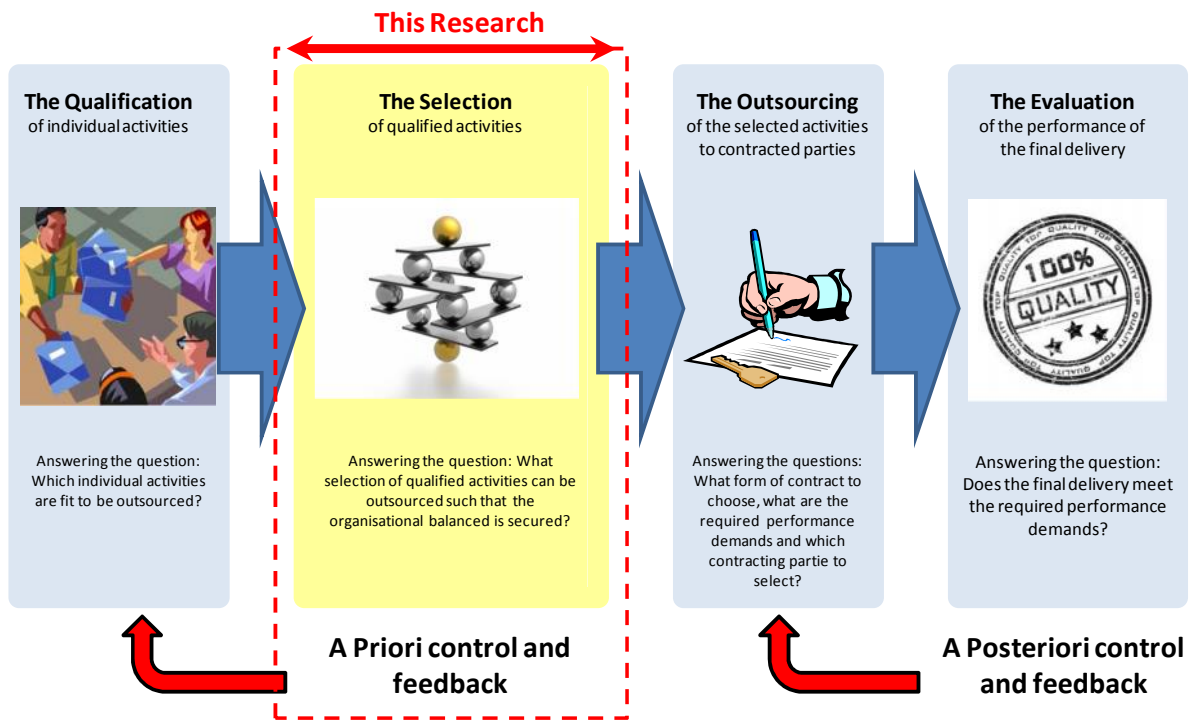


Figure 2: The 4 Phases of Outsourcing

*RBM (Risk Based Maintenance)*

RBM is defined within RWS as ‘a risk based way of maintaining and managing objects, which continually proves that the RAMS requirements are met’. RAMS stands for Reliability, Availability, Maintainability and Safety. RAMS requirements are determined by the probability and possible consequences of the failure of an object. RBM is a

strategy to reduce risk of failure to an acceptable level; it has been used to reduce costs to an acceptable risk level as well. This strategy is not exhaustive because it is based on calculated possibilities and consequences.

### *The Relation between Outsourcing and RBM*

Because of the risks involved and the possible severe consequences, one can speak of a special form of outsourcing in the case of RBM activities. An important question to ask is: 'What is the potential consequential loss when outsourced activities are not executed correctly?' The question of the degree of outsourcing is all the more relevant with critical objects because preventing an incident is a necessity and correcting afterwards is too late while the harm already has taken place.

### *Criteria for RBM Outsourcing in Literature*

Academic literature offers many different criteria for the selection of activities suitable for outsourcing. The criteria for the degree of outsourcing can be divided into two questions; a quantitative question e.g. 'how much?' and a qualitative question e.g. 'how complex?'. It is important to note that outsourcing RBM activities entails an inherent contradiction. The commissioning party's first goal is to keep the risks as low as possible and secondly to reduce costs to the limits of acceptable risk. The contracted party however, looks mainly for profit and will try to reduce the costs of RBM activities to the acceptable risk. How acceptable risk is defined is multi-interpretatable, making good contractual agreement invaluable.

### *Criteria for the Functioning of RBM*

For this research the criteria for the a priori check and feedback are most relevant. According to literature functioning of RBM within the organisation is determined by three main factors:

- Control over Execution of Business Strategy
- Control over Risk Determination
- Control over Performance of Execution of RBM

In the studied literature also three main factors for the degree of outsourcing can be found:

- Preservation of Knowledge
- The Intensity of Consequential Loss
- The Contract Type

### *Resilience Engineering*

The theory of resilience engineering is concerned with the question how much an organisation can change before it becomes a different kind of organisation. Resilience engineering helps organisations deal with influences like increasing complexity, increasing unpredictability, vulnerability and the speed of distribution. Factors indicative of resilience in an organisation are responsiveness, anticipation, monitoring and preparedness. These have a direct connection to an organisation's control over strategy and control over execution. Another factor, learning ability, has

a relation to preservation of knowledge. Other indicative factors of resilience can also be directly linked to strategy and execution. Whether or not Resilience Engineering can be used as a tool for determining the degree of outsourcing of RBM activities will become clear from the interviews with experts. Additionally, a proposal for a radar plot will be discussed as a benchmark tool for the acceptable degree of outsourcing RBM activities.

## **3. Methods**

This is descriptive research, based on a single case study. Relevant literature was studied to set up the theoretical framework and interviews were held with experts on RBM from the industrial and public sector. The interviewees also received a questionnaire after their interview which has been used for the design of a radar plot. By using a wide range of sources representative of the literature present and interviewing experts from different fields the validity and reliability of this research has been increased. This research does not pretend to any scientific claims but instead aims to give practical suggestions for further research on the outsourcing of RBM activities.

## **4. Results**

### *RBM and Lean Management in Practice*

Estimating risks and controlling them is seen as the main goal of maintenance in general. It is mentioned that in principle all maintenance is risk based. Legislation and instructions are a central factor in determining risks. The programme of RBM is seen by the experts as a way to reduce costs; especially by those in the public sector. They also feel there is a tension between the Lean Management programme and RBM processes. This is felt less in the industrial sector where Lean working is seen as a given. The experts from the public sector feel that Lean compromises the quality of maintenance activities and that RBM is a process which includes aspects that cannot be outsourced. Apart from one interviewee, all the experts agreed that the responsibility and therefore control should always be done by the organisation itself. Outsourcing an audit process is identified as absolutely impossible and highly undesirable.

### *Outsourcing in Practice*

Types of contracts as mentioned in the literature are not recognized by the experts. In the industrial sector contract types are diverse and based on the situation. In the public sector there is a limited range of template contracts which will be adapted to the situation. Often, and especially in the public

sector, there is a divide between the settlement of the contract and the actual execution. This strict division between contract management and maintenance management leads to a gap between the theory of the contract and the practice of maintenance execution. This causes problems later during the contract execution phase. After the contract has been drawn up, collaboration is seen as a vital factor for a successful outsourcing process. Although a contract is needed to prevent opportunistic behaviour from the contracted party, flexibility is needed for a smooth collaboration from both parties. Especially when constructions or installations change performance contracts can become problematic. For the public sector European legislation can form an obstacle for outsourcing because contractors who have performed badly in previous contracts cannot be excluded from a new tender in any way. Despite these problems none of the experts' organisations uses a priori feedback when considering outsourcing RBM activities. They confirm that this is a lost opportunity that could be useful. For the correct functioning of RBM specialist knowledge and historical knowledge are seen as important, although the last one is not always possible with unique or fast-changing installations. Another important aspect that was not present in the literature is the motivation of the staff for the execution of RBM and maintenance. With extensive outsourcing this aspect does not always remain under control of the organisation.

#### *Outsourcing RBM activities in Practice*

Whether activities will be outsourced or not is dependent on:

- How essential the object is for the primary tasks of the organisation
- Possible consequences of failure of an object
- Alternative arrangements upon failure of an object
- Availability over knowledge and documentation for auditing the execution of outsourced activities
- Motivation of own staff to manage and maintain the object or installation

The presence of sufficient knowledge and experience within the organisation is emphasized by the experts, especially when failure of objects can cause unacceptable damage, objects are exceedingly complex or a contract is based on the collaboration between the commissioning and contracted party.

Most of the interviewed experts spoke about the widespread occurrence of opportunistic behaviour of contractors. In complex situations it is difficult to make contracts that will prevent contractors from maximizing profits while minimizing costs of

execution. The interviewees experience a dilemma between a rigid contract to prevent opportunism and flexibility to ensure a smooth collaboration. It is said that an outsourced contract succeeds with a good collaboration.

#### *Criteria for Outsourcing RBM Activities*

The criteria for outsourcing as found in literature have been checked with the experts from the field. Their own suggestions have been added as criteria.

- **Control over Execution of Business Strategy**  
While not all experts were familiar with the term Execution of Business Strategy, it is recognised that an organisation always has responsibilities that cannot be transferred to external parties. Related to this is the preservation of knowledge in the organisation itself. However, because this criterion is difficult to quantify recognition is limited.
- **Control over Risk Determination**  
This criterion was directly acknowledged. The more activities are outsourced, the less control there is within the organisation on risk determination. The loss of knowledge of risks also makes it more difficult to draw up contracts with external parties.
- **Control over Performance of Execution of RBM**  
Control over performance of execution of RBM is recognised as a very important criterion. When too many RBM activities are outsourced the organisation cannot control the quality of the execution of maintenance. In the public sector the faith in outsourcing is so extreme that in known cases the outsourcing organisations have no longer control over how the outsourced activities are carried out. The importance of the possibility to supervise the staff executing the work is also noted by different experts.
- **Preservation of Knowledge**  
By far the most repeated criterion is the preservation of knowledge and experience in the organisation. The responsibility for an installation and the consequences of decisions always remains with the organisation. When outsourcing goes too far it leads to loss of essential knowledge and experience of objects. Experts from the public sector declare that the limits for this criterion have been reached and in several cases have been crossed.
- **The Intensity of Consequential Loss**  
Only one interviewee believes that technically everything can be outsourced. The rest of the experts subscribe to the viewpoint that some calculated risks are too high to outsource. Especially the industrial sector is very clear on that point; objects which are critical or at risk from extreme consequential loss will always be

managed and maintained by the organisation itself.

- **Motivation of Staff**

In several interviews the motivation of staff was declared indispensable for the functioning of RBM activities. The motivation of experienced staff in a fast-paced changing environment is essential. Their knowledge makes the difference for differentiation and the competitive position of the organisation. The degree of outsourcing is often dependent on internal staff being able to supervise the process. In the public sector this has currently reached the acceptable limit.

- **Influence on the Contractor**

The second criterion, added after the interviews, is the ability to influence the contracted party. The point of departure for this criterion is the organisation's strategy. The interests of the outsourcing and contracted parties are often far apart. Therefore, influence on the contract and prevention of opportunistic

behaviour is vital to ensure a successful collaboration and a smooth outsourcing process.

- **The Contract Type**

The contract type was not perceived to be an important criterion for the determination of the degree of outsourcing of RBM activities.

*Radar Plot*

A tool for visualising and benchmarking the status of outsourcing is developed in the form of a Radar Plot. The radar plot is not meant to be measuring absolute values but can be an instrument to give insight into the situation. It can show how certain proposals stand in comparison with the real situation. It can be a useful tool in discussions to explain complex situations visually and support arguments in favour or against outsourcing of RBM activities. The interviewed experts noted that other tools like these already exist and that it cannot be a definitive measuring instrument.

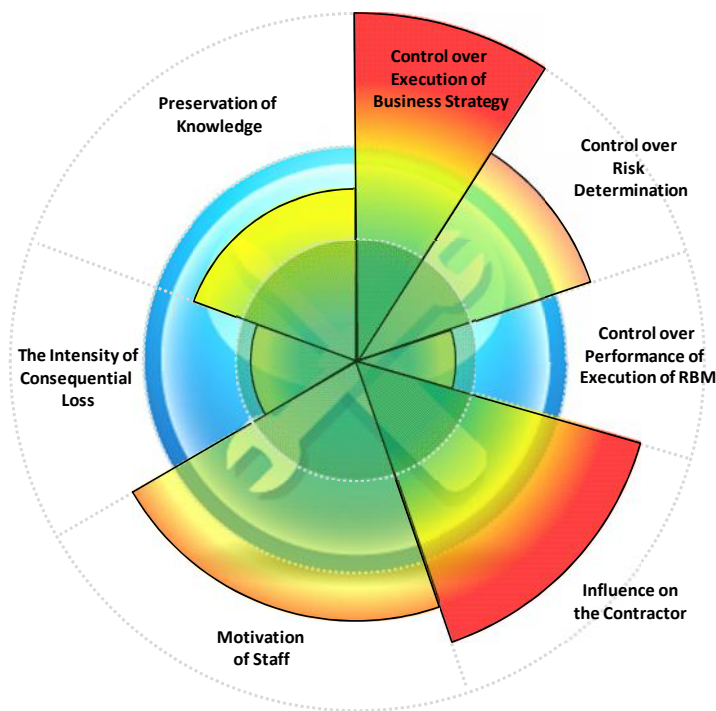


Figure 3: Proposed Radar Plot

## 5. Conclusions

### *Outsourcing*

The definition of outsourcing in theory and in practice does not differ much. Literature applies a narrower definition than the field, where outsourcing means everything that is 'put on the market'. Because this research dealt with outsourcing of RBM activities, which are critical processes by definition, the differences between literature and practice are negligible.

The reality of outsourcing does not correspond with theory mentioned in literature. A priori check and feedback are not found in the literature and only a posteriori feedback is mentioned. Furthermore, contract designs are described only vaguely and it has proved impossible to make a list of existing contract designs.

### *RBM*

RBM is a method to organise maintenance based on control over risks. As it is risk-driven, it aims to find the limits of acceptable risks and tries to get as close to those limits as possible. Outsourcing of RBM knows several contradictory aspects, for example, RBM aims to manage risk but by outsourcing RBM activities it gives up management to an external party with potential loss of control over risk management. Also, while RBM strives to reduce an unacceptable high risk level to an acceptable risk level, the same method is used to look for the acceptable limit from low risk level to acceptable risk level (see figure 4). Finally, RBM is used to determine certainties based on estimates.

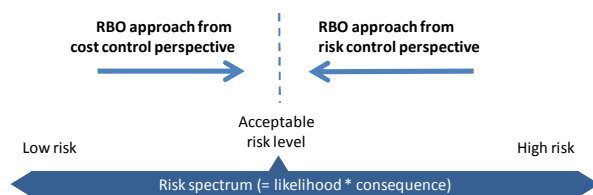


Figure 4: Contradiction in Outsourcing RBM

### *Resilience Engineering*

The theory of resilience engineering is still very new and too broad to make a univocal connection to outsourcing of RBM. The radar plot tries to give an insight in the effect of resilience on the organisation of RBM outsourcing.

### *Criteria for outsourcing of RBM activities in theory and in practice*

Criteria found for the functioning of RBM in literature are firstly *control over execution of business strategy*, secondly *control over risk determination* and thirdly *control over performance of execution of RBM*.

It can be concluded that contract design is not a criterion for the degree of outsourcing RBM activities. However, from the interviews it turns out that motivation of staff is essential for the functioning of RBM and it has been added as a criterion. A second criterion that came out of the interviews is influence on the contractor. Opportunistic behaviour of contracted parties is an issue that becomes more frequent when more activities are outsourced. For the degree of outsourcing also three criteria were identified; firstly *preservation of knowledge*, secondly *intensity of consequential loss*, thirdly *the contract design* and fourthly *influence on the contractor*.

Based on these findings criteria for the tolerable degree of outsourcing are preservation of knowledge, motivation of staff and influence on the contractor. These criteria are strongly influenced by intensity of consequential loss in case of failure of an object. The criteria for the functioning of RBM found in literature remain the same after checking it with the experts.

### *Resilience Engineering in practice*

The question whether resilience engineering can be of added value has been answered positively by all experts. Critical comments were made about the ability to measure the criteria of resilience. These comments were overcome when it was explained that the radar plot is a useful tool and not an absolute measuring instrument. In particular the public sector expressed a need for more tools to be able to explain the complex environment and pressures of RBM to higher management. Further development of the radar plot could be useful for this.

### *Other outcomes*

This research has found a significant difference in outlook between the public and industrial sector. While in the industrial sector outsourcing critical business processes is out of the question, the public sector emphasizes market processes and cost reduction and will consider outsourcing primary business processes and activities.

In the public sector the Lean programme is seen as a cost reduction method with outsourcing as a result. Industrial experts indicated that it was more integrated and focused on optimizing processes.

The contradictions found within execution of the RBM programme are further increased by the Lean method and causes a further approximation of the limits of acceptable risk. The public sector experts also declared that the limits of outsourcing have been reached, especially with the threat of losing valuable and necessary knowledge.

At the moment no a priori check and feedback is done when going through the outsourcing process. Adding this step would be a welcome addition to the process to avoid exceeding the tolerable degree of outsourcing.

Opportunistic behaviour from contractors can be concluded to be a real problem. Extensive outsourcing and the consequential loss of knowledge and experience will cripple an organisation. This is a clear line that should not be crossed. In organisations considering outsourcing internal opportunistic behaviour can also occur. Managers looking for short-term results without considering long-term consequences can cause damage to the organisation. Corporate governance should also look critically at outsourcing primary business processes and its responsibilities.

## 6. Recommendations

The first recommendation is to start further research into the found criteria. It is especially interesting to look at how influential each criterion is on the tolerable degree of outsourcing RBM activities.

There are several recommendations that are aimed at the daily practice of organisation working with RBM activities and are (considering) outsourcing:

- The Lean programme has gained a bad reputation in the public sector, organisations should work on the image of Lean and integrate the programme into existing processes instead of implementing it as an independent programme.
- The experts in the public sector feel like they are not being listened to by higher management. Ignoring clear signs from the floor can result in catastrophic consequences in the case of some objects and installations. It is highly recommended to listen to the people on the floor working with RBM activities daily.

- It is advisable to take wider margins with the tolerances of the found criteria when the intensity of consequential loss might be higher.
- The strategy of the organisation should be observed, also when outsourcing RBM activities.
- Adding a priori check and feedback to the outsourcing process is highly recommended.
- To solve the dilemma of rigidity and flexibility in drawing up contracts an improved communication between technical execution and drawing up of the contract is advised.
- More attention to preventing opportunistic behaviour of contractors when drawing up the contract.
- To prevent internal opportunistic behaviour crucial strategic decisions like outsourcing critical business processes should be the responsibility of higher management and the board.

For further research two recommendations can also be made. It will be interesting to follow the developments of the relatively new theory of resilience engineering in relation to the specific topic of this research. In addition, the radar plot can be expanded further by researching the influence of each of the criteria.

## 7. Reflections

During research it was found that little is written on this specific topic. Definitions are not defined clearly and only a restricted overview of criteria and relations was possible. The correlations found with the practical experiences of the experts increases the validity of this research. The results of this research can be an important contribution to the theories on this complex topic.

It has been shown that organisations and the public sector in particular, have a need for tools that can prevent further erosion of maintenance and management of objects by cost reduction programmes. The practical insights found in this research can contribute significantly to achieving a better balance between cost reductions and managing and maintaining objects to the limits of acceptable risks.